March 27, 2013

FAQs: Mussel Monitoring Update for Lake Powell

1. **What was found?**
   Fourteen widely dispersed adult quagga mussels were found attached to moored houseboats and dock structures. The mussels were alive, but too far apart to successfully reproduce.

2. **Where were they found?**
   The adult mussels were found at the Waheap Marina. Surveys were conducted in the Antelope Point area beginning in December, 2012 and no mussels were detected.

3. **How were they found?**
   Employees of a local marine services business discovered the first four mussels on a single houseboat that had been removed from moorage for annual cleaning and maintenance. They contacted Glen Canyon National Recreation Area staff on March 18th to identify the organisms. NPS staff confirmed they were quagga mussels. Divers discovered the additional mussels as they searched nearby.

4. **Why is this important?**
   No adult mussels have been found in Lake Powell prior to last week. The mussels appear to have attached and grown on the boats and structures while they were in the lake. The mussels were too far apart, however, to reproduce.

5. **What are the next steps?**
   Diver surveys will continue in the coming weeks to determine the extent of the number of mussels. When found, mussels are physically removed from the lake to prevent reproduction. The NPS will continue all of our mussel prevention activities including inspections of boats. Preventing the spread of Quagga mussels and other aquatic invasive species is more important than ever.

6. **If control strategies are not effective, how soon could Lake Powell start experiencing mussel impacts?**
   Should a mussel population get established and spread, it could be several years before their presence would be obvious. Spreading lake-wide could take considerably longer.

7. **What can the public do to help?**
   Clean, drain, and dry! The spread of mussels and other aquatic invasive species is preventable. Cooperate with prevention program efforts at Lake Powell and other places where people are trying to protect their waters. Always make sure your vessels and equipment are not causing the problem. Spread the message, not the mussels.

8. **Are boat inspections still required at Lake Powell?**
   Yes.

9. **Can boats leaving Lake Powell spread mussels to other waters now?**
   Not if boaters practice "Clean, Drain, and Dry" and treat their boats and equipment to prevent spreading aquatic species.

10. **What effect will this have on the Colorado River below the dam in Glen and Grand canyons?**
    These detections are so low that no effect will occur. If a large infestation of Quagga mussels existed in Lake Powell, large numbers of mussel larvae might travel through the dam. The larvae that survived would seek to attach in low flow areas. It is not known if they could reach high numbers. The Arizona Canal has not yet developed large populations of mussels despite larvae being delivered from the Lower Colorado River.

11. **What has the NPS done to stop mussels at Lake Powell?**
    The NPS has operated a mussel prevention program at Lake Powell since 2000. Over a decade ago, scientists predicted that Lake Powell would be the first lake in the western U.S. to get mussels. The number of high-risk boats coming to the park has increased exponentially in that time. Prior to 2007 and the discovery of mussels in the west, Lake Powell was threatened by about 50 high-risk boats per year from eastern states. In 2011 alone, that number was 17,000. 38 boats with mussels were stopped from launching in 2012, over twice the number in 2011. The increased pressure has required the park to screen boats to determine the highest risks and focus our limited capability where it was needed most. At busy times, as few as 15% of boats may actually get inspected.

12. **How does NPS monitoring at Lake Powell compare to other mussel monitoring programs?**
    No other lake on earth is as intensely monitored for mussels as Lake Powell. The NPS processes hundreds of samples each year. The NPS uses 4 early detection methods, including microscopic analysis, automated particle analysis (FlowCAM), Polymerase Chain Reaction (the DNA test), and deployment of artificial substrates to detect early colonization. Sampling occurs lake-wide at routine sites like marinas and the dam; computers are also used to determine random sampling locations throughout the lake. More samples collected are from areas where there are the most boats. Using both routine and random sampling as well as multiple early detection methodologies is expected to increase the chances of very early detection. Control of any invasive species is easiest when caught early. If these current findings represent a population, the best chances have been created for successful control.

Control Strategy Table

APPROACH	DESCRIPTION	COMMENT
Remove	Remove the mussels by hand, suction, scraping or hydro-blasting combined with suction, or other methods.	• The initial removal of 19,000 Zebra mussels by hand from Lake George, New York in 2000, with smaller annual follow-ups successfully controlled the population. • Removal of 1.6 million snails by hand from a southern California intertidal cove eradicated a parasite that used the snail as a host. • Suction dredges of various sizes have been used for biological sampling of the bottom, underwater archaeological excavation, and dredging sediment.
Remove Surfaces	Remove infested surfaces such as boats or marina sections.	• Diver inspections of boats in a Lake Powell marina were conducted in 2007 when monitoring results indicated potential mussels nearby. It was a false alarm, but the hope was to find and remove an early population before it established on a natural surface.
Bury	Bury with clean sediment	• Typically using dredges.
Wrap	Wrap or cover the infested surfaces.	• Covering of Zebra Mussels with large plastic tarps in Lake Saratoga, New York, killed 99.9% of the mussels, apparently by the combined stress of no food, low oxygen, high ammonia concentrations, etc.
Wrap & Treat	Isolate the infested surfaces by wrapping or covering them, and inject a chemical or pesticide under the wrap or cover.	• Two infestations of seaweed (*Caulerpa taxifolia*) in southern California lagoons were eradicated by covering with PVC tarps held down by sandbags around the edges, and pumping chlorine underneath through valves in the tarps.
Heat	Apply heated water, steam or flame to infested surfaces.	• In 2001, exotic seaweed (*Undaria pinnatifida)* was eradicated from the hull of a sunken vessel off Chatham Island, New Zealand, using electric heating elements inside a plywood box attached to the hull with magnets. Small inaccessible areas were treated with a modified cutting torch. • Superheated steam has been applied to populations of Brown kelp (*Undaria*).
Coat	Spray with an underwater polymer or other coating.	• Smothers mussels.
Isolate & Treat	Isolate the infested area with curtains, inflatable barriers, earth berms, etc. and treat the isolated water with chemicals or pesticide.	• Isolation curtains have been used for the pesticide treatment of aquatic plants. • Inflatable barriers are being installed to protect the City of Venice from flood waters. • Corrugated metal bulkheads have been used to contain construction sediment. • Isolation/barrier technologies developed for containing chemical spills or sediments raised by dredging might be applicable.
Biological Control	Release live organisms to control the target population through predation, parasitism, interference with reproduction, or other mechanisms.	• There is no demonstrated biological control treatment for Quagga or Zebra mussels.